New section

14.14 Small scale embedded generators (SSEGs)

14.14.1 The Law

The Electricity Safety Quality and Continuity Regulations 2002 exempt sources of energy with an electrical output not exceeding 16 amp per phase at low voltage from regulations 22(1)b and 22(1)d of the Regulations. This relaxation is to encourage the use of alternate sources of energy such as renewable and combined heating and power. Such generators are required to meet regulation 22(1) a and d as follows:

22. -(1): No person shall operate a source of energy which may be connected in parallel with a distributor’s network unless he:

a) has the necessary and appropriate plant and equipment to prevent danger or interference with that network or with the supply to other consumers, so far as reasonably practical; and

d) for low volt installations complies with the provisions of the British Standard requirements.

The British Standard requirements referred to are those of BS 7671 and the section specific to generators is 551: Generating Sets.

There are special requirements for small scale embedded generators (SSEGs) in Regulation 22. -(2) as follows:

c) the source of energy is configured to disconnect itself electrically from the parallel connection when the distributor’s equipment disconnects the supply of electricity to the person’s installation; and

d) the person installing the equipment ensures that the distributor is advised of the intention to use the source of energy in parallel with the network before, or at the time of, commissioning the source.

It is necessary for such equipment to be type tested and approved by a recognised approval body.

14.14.2 Engineering Recommendation G83

To assist network operators and installers the Electricity Association has prepared engineering recommendation G83: Recommendations for the connection of small scale embedded generators (up to 16 amps per phase) in parallel with public low-voltage distribution networks.

The recommendation is for all small scale embedded generator installations with an output up to 16 amps per phase, single or multi-phase, 230/400V including:

- Domestic combined heat and power (DCHP)
- Micro hydro
- Micro wind
- Photovoltaic
- Fuel cells.

Engineering Recommendation G83 includes application forms for the connection of multiple SSEGs and commissioning confirmation for single SSEGs. The supply of information in this form, for a type tested and approved unit, is intended to satisfy the legal requirements of the ESQC Regulations.

14.14.3 Installation

Both G83 and the Electricity Safety Quality and Continuity Regulations require the electrical installation connecting the embedded generator to the supply to comply with BS 7671.

Overcurrent protection

A suitably rated overcurrent protective device is required to protect the wiring between the electricity supply terminals and the embedded generator.

Isolation

The SSEG is required to be connected directly to a local isolating switch. For single-phase machines the phase and neutral are to be isolated and for three-phase machines all phases and the neutral are to be isolated. In all instances the switch, which must be manual, shall be capable of being secured in the off isolating position. The switch is to be located in an accessible position in the customer’s installation.
Figure 14.4 Isolation of small scale embedded generators (SSEG)

Regulation 551-07-04 requires that means shall be provided to enable the generating set to be isolated from the public supply and the means of isolation shall be accessible to the supplier (or distributor) at all times. It is understood that the electricity distribution network operators will accept the distribution cut out (fused unit) as the means of isolation. This is considered to be accessible in the sense that all metering equipment is accessible to the distributor. In practice when small scale embedded generators are common, it will be difficult for a distributor to identify all the locations where embedded generators are installed and equally difficult to isolate all the equipment.

**Interface protection**

The legal requirement for all generators is that the source of energy must be configured to disconnect itself electrically from the parallel connection when the distributor’s equipment disconnects the supply of electricity to the consumer’s installation. See Electricity Safety Quality and Continuity Regulation 22(2). This is an essential requirement.

The DTI advise that the means of disconnection for interface protection should preferably be by mechanical separation, however a suitable solid state switching device is permitted if it is equipped with fail safe monitoring to ensure the phase to neutral voltage on the mains side of the device reduces to less than 50V within 0.5 s of the device failing to operate when required to do so.

**Approval**

Only type tested and approved equipment that meets this requirement will be allowed to be connected.

14.14.4 Earthing

When an SSEG is operating in parallel with a distributor’s network there shall be no direct connection between the generator winding (or pole of the primary energy source in the case of PV array or fuel cell) and the network operators earth terminal. See figure 14.5.

Figure 14.5 Earthing for small scale embedded generators

14.14.5 Labelling

There are specific requirements for labelling. Labels are required at:
- the supply terminals (fused cut out)
- the meter position
- the consumer unit and
- at all points of isolation.

The labels are required to indicate the presence of the SSEG in the premises. The Health & Safety (Safety Signs & Signals) Regulations 1996 require that the labels should display the prescribed triangular shape and size using black on yellow colouring. A typical label is shown below.

Figure 14.6 SSEG warning

The engineering recommendation also requires up-to-date information to be displayed at the point of connection with the distributors network. The information required is:

a) a circuit diagram showing the relationship between the embedded generator and the network operator’s cut out. The diagram is also required to show by whom the generator is owned and by whom it is maintained.

b) a summary of the protection settings incorporated within the equipment.

Figure 14.7 is an example for illustrative purposes only and not intended to be descriptive.

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14.4.6 Domestic combined heat and power (DCHP)

Engineering recommendation G83 specifies the particular requirements for combined heating and power sets that have been agreed by the distributors. This will help manufacturers by specifying acceptable performance criteria including that of the interface with the electricity supply.

DCHP generators are likely to be the most common type of small scale embedded generation encountered by the electricity installer, as they can replace household gas central heating boilers. Most small scale DCHP generators use sterling engines (see figure 14.8). The sterling engine does not burn the gas within the cylinder, the power to the engine is conducted heat from the combustion gases of the gas burner and the energy transfer achieved by the temperature difference between the burner exhaust gases and burner input air or circulating water.

Figure 14.8 Stirling Engine

14.4.7 Solar photovoltaic power supply systems

It is necessary for solar photovoltaic power systems to comply with the requirements of the Electricity Safety Quality and Continuity Regulations in the same way as any other small scale embedded generator. Amongst other requirements, they must be configured to disconnect from power connection when the distributors equipment disconnects the supply of electricity to the consumers installation.

There is an IEC standard for photovoltaic systems, IEC 60364-7-712: Requirement for special installations or locations – solar photovoltaic power supply systems, which has not yet been included in BS 7671. Guidance on the installation of photovoltaic systems is to be found in “Guide to the installation of PV systems” report S/P2/00355/REP/1, published in 2002. Authors are BRE, EA Technology, Halcrows and Sundog. Another useful source of information is the British Photovoltaic Association on www.pv-uk.org.uk.

Engineering recommendation G 77 Recommendations for the connection of inverter-connected single-phase photovoltaic (PV) generators up to 5kVA to public distribution networks is to be withdrawn when Annex E (photovoltaic) of G 83 is published.

Bibliography

Chapter Fourteen

Engineering Recommendation G 83- Electricity Association
Engineering Recommendation G 77- Electricity Association
Electricity Safety Quality and Continuity Regulations 2002 Statutory Instrument 2002 No. 2665-HMSO
Guidance on the Electricity Safety Quality and Continuity regulations 2002- DTI publication reference URN 02/1544